

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Carl Towns et al.

Application No.: 10/533,920

Confirmation No.: 2378

Filed: June 7, 2005

Art Unit: 1794

For: ARYL-SUBSTITUTED
POLYINDENOFLUORENES FOR USE IN
ORGANIC ELECTROLUMINESCENT
DEVICES

Examiner: M. E. Nelson

1.132 DECLARATION

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

1. I, Dr. Heinrich Becker, am a citizen of Germany and reside at Hofheim, hereby declare and say as follows:
2. I am a fully trained chemist, having studied at the University of Frankfurt, Germany
I am well acquainted with technical English.
3. Work experience:

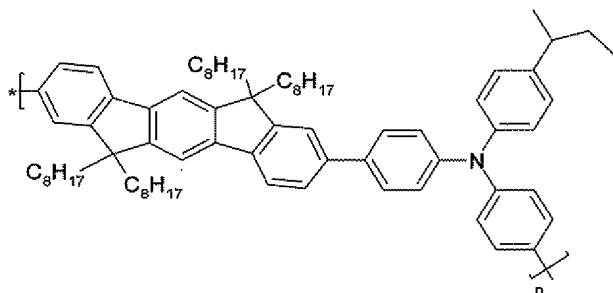
| | |
|---------------------|---|
| 2005–present | research, scaling and production of Light Emitting Polymers at Merck KGaA. |
| 1999–2005 | Manager Research & Development at Covion Organic Semiconductors GmbH. |
| 1998–1999 | Laboratory manager at Covion Organic Semiconductors GmbH. |
| April 1998 | Inaugural member of the management team of Covion Organic Semiconductors GmbH. |
| 1995–1998 | Laboratory manager at the corporate research of Hoechst AG (Light Emitting Organics project). |
4. In the field of organic light emitting diode (OLED), I am an inventor on more than 40 U.S. patents and patent applications and an author of more than 30 publications and lectures.

5. In view of my qualifications as outlined above, I consider myself to be an expert and to be skilled in monomer synthesis, polymerization, and OLED field.
6. I have read and reviewed this application, U.S. Application No. 10/533,920 (" '920 application").
7. I had the following experiment conducted under my supervision:

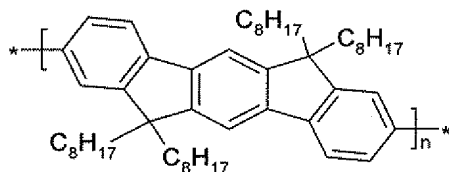
The following polymers have been prepared in accordance with the polymerization method described in the present application.

Two types of polymers were prepared for each monomer; a homopolymer and an alternating copolymer (as described in the present application)

Comparative example 1 (as described on page 31 and 32 of the present application):

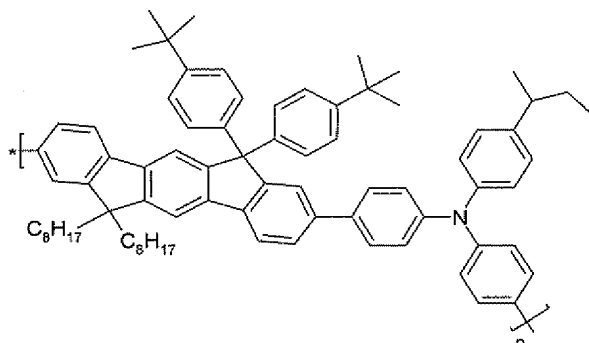


Comparative example 2:

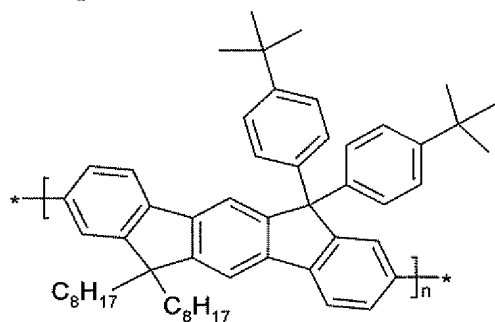


The synthesis of the monomer for the following examples 1 and 2 is described in the present application.

Example 1

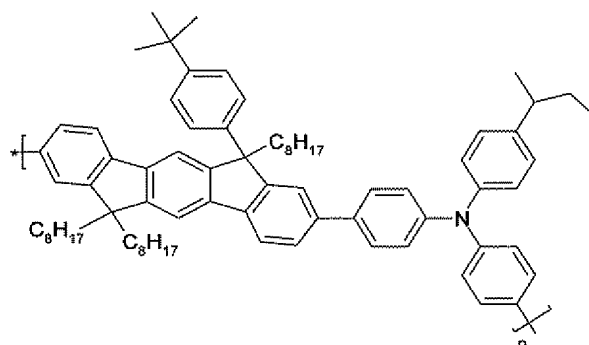


Example 2:

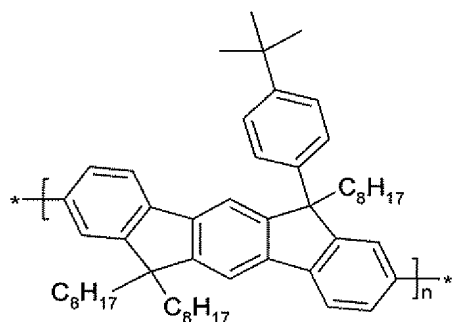


The mono-aryl substituted monomer for the following examples 3 and 4 has been synthesized according to Scheme 2 (page 16) of the present application, except that the intermediate is only reacted with one equivalent of $\text{ArBr}/n\text{BuLi}$, is subsequently cyclized and then reacted with 1.1 equivalent of $n\text{-C}_8\text{H}_{17}\text{Br}/\text{KOH}$.

Example 3

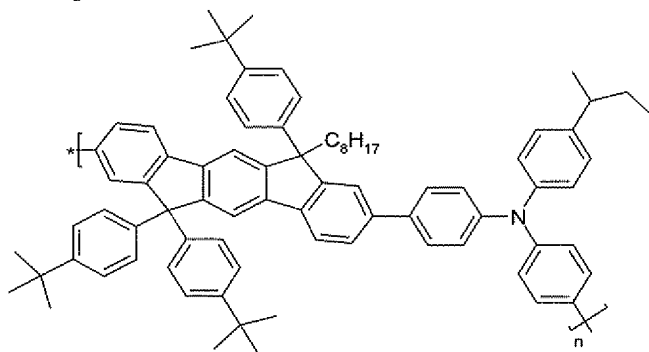


Example 4:

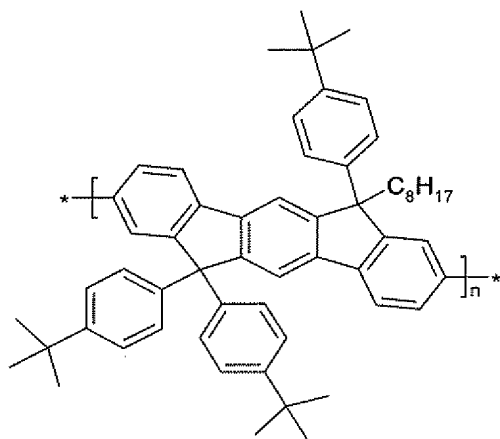


The tri-aryl substituted monomer for the following examples 5 and 6 has been synthesized analogue to Scheme 4 (page 18) of the present application, except that compound 1d has been replaced with a mono-aryl substituted boronic-ester.

Example 5

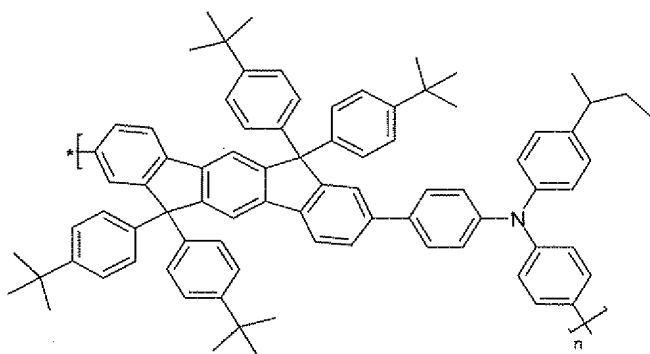


Example 6:

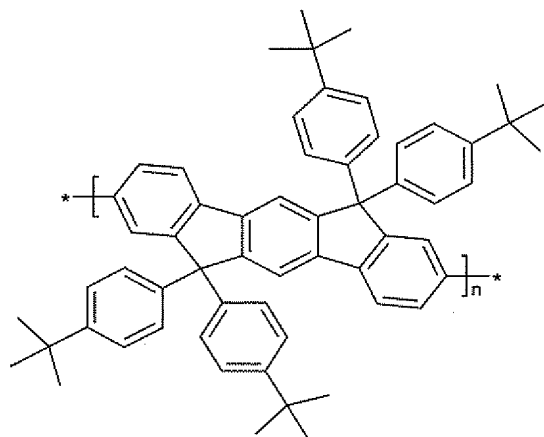


The tetra-aryl substituted monomer for the following examples 7 and 8 has been synthesized according to Scheme 1 (page 15) of the present application.

Example 7



Example 8:



The properties of the polymers and their molecular weights are summarized in the following Table 1.

Table 1

| Example | MW [kg/mol] | Tg [°C] |
|-----------------|-------------|-----------|
| Comp. Example 1 | 398 | 167 |
| Comp. Example 2 | 326 | 152 |
| Example 1 | 421 | 240 |
| Example 2 | 386 | 221 |
| Example 3 | 365 | 208 |
| Example 4 | 459 | 201 |
| Example 5 | 452 | 238 |
| Example 6 | 399 | 220 |
| Example 7 | 401 | 232 |
| Example 8 | insoluble | insoluble |
| | | |

Thermal annealing has shown to be beneficial to OLED Performance (Journal of Applied Physics (2002), 91(3), 1595-1600). Typically, 180°C is used as an annealing temperature. The reference examples are not compatible with the annealing procedure, as the Tg is significantly lower.

The data above clearly establishes that the trans-indenofluorenes, which have at least one aryl group as substituent, have unexpected superior properties compared to the trans-indenofluorenes having only alkyl-substituents.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.



July, 16th, 2008
Date